

Listing of Claims

1 1. (previously presented) An MRAM cell comprising:
2 a magnetic tunneling junction including
3 a free layer,
4 a pinned layer, and
5 a spacer layer disposed between the free layer and the pinned
6 layer;
7 a digit line including a bit line segment disposed proximate to the
8 magnetic tunneling junction;
9 a bit line including a bit line segment in electrical contact with the
10 magnetic tunneling junction; and
11 a magnetic liner layer disposed around the bit line segment and
12 contacting the free layer.

1 2. (previously presented) The MRAM cell of claim 1 wherein the digit line
2 segment is disposed proximate to the pinned layer and the bit line
3 segment is in electrical contact with the free layer.

1 3. (previously presented) The MRAM cell of claim 1 wherein the bit line
2 segment is disposed proximate to the pinned layer and the digit line
3 segment is in electrical contact with the free layer.

1 4. (previously presented) The MRAM cell of claim 1 wherein the magnetic liner
2 layer is electrically conductive.

1 5. (previously presented) The MRAM cell of claim 1 wherein the bit and digit
2 lines are formed of a metal selected from the group consisting of Cu, W,
3 and Al.

1 6. (previously presented) The MRAM cell of claim 1 further including an
2 antiferromagnetic layer disposed adjacent to the pinned layer.

1 7. (previously presented) The MRAM cell of claim 1 wherein the magnetic liner
2 layer is formed of Permalloy.

1 8. (previously presented) The MRAM cell of claim 7 wherein the Permalloy is
2 between 16 and 22 atomic percent iron.

1 9. (previously presented) The MRAM cell of claim 7 wherein the Permalloy is
2 $\text{Ni}_{81}\text{Fe}_{19}$.

1 10. (previously presented) The MRAM cell of claim 1 wherein the magnetic liner
2 layer has a thickness of about 20Å to about 500Å.

1 11. (previously presented) The MRAM cell of claim 1 wherein the magnetic liner
2 layer has a thickness of about 30Å to about 100Å.

1 12. (previously presented) The MRAM cell of claim 1 wherein the magnetic liner
2 layer is formed of a material selected from the group consisting of CoZrCr,
3 CoZrNb, CoZrRe, FeSiAl, FeN, FeAlN, FeRhN, and FeTaN.

1 13. (previously presented) The MRAM cell of claim 1 wherein the pinned layer
2 is two ferromagnetic layers separated by a spacer layer.

1 14. (previously presented) The MRAM cell of claim 1 wherein the free layer is
2 two ferromagnetic layers.

1 15. (previously presented) An MRAM cell comprising:
2 a magnetic tunneling junction including
3 a free layer having a magnetization orientation,
4 a pinned layer, and
5 an insulating spacer layer disposed between the free layer and the
6 pinned layer;
7 a digit line including a segment disposed proximate to the pinned layer;
8 a bit line including a segment in electrical contact with the free layer;
9 a magnetic liner layer disposed around the bit line segment and
10 contacting the free layer such that a magnetic field encircles the bit
11 line segment.

1 16. (previously presented) The MRAM cell of claim 15 wherein the magnetic
2 liner layer is electrically conductive.

1 17. (previously presented) The MRAM cell of claim 15 wherein the bit and digit
2 lines are formed of a metal selected from the group consisting of Cu, W,
3 and Al.

1 18. (previously presented) The MRAM cell of claim 15 further including an
2 antiferromagnetic layer disposed adjacent to the pinned layer.

1 19. (previously presented) The MRAM cell of claim 15 wherein the magnetic
2 liner layer is formed of Permalloy.

1 20. (previously presented) The MRAM cell of claim 19 wherein the Permalloy is
2 between 16 and 22 atomic percent iron.

1 21. (previously presented) The MRAM cell of claim 19 wherein the Permalloy is
2 $\text{Ni}_{81}\text{Fe}_{19}$.

1 22. (previously presented) The MRAM cell of claim 15 wherein the magnetic
2 liner layer has a thickness of about 20Å to about 500Å.

1 23. (previously presented) The MRAM cell of claim 15 wherein the magnetic
2 liner layer has a thickness of about 30Å to about 100Å.

1 24. (previously presented) The MRAM cell of claim 15 wherein the pinned layer
2 is two ferromagnetic layers separated by a spacer layer.

1 25. (previously presented) The MRAM cell of claim 15 wherein the free layer is
2 two ferromagnetic layers.

1 26. (previously presented) An MRAM cell comprising:
2 a magnetic tunneling junction including
3 a free layer,
4 a pinned layer, and
5 an insulating spacer layer disposed between the free layer and the
6 pinned layer;
7 a digit line including a segment disposed proximate to the pinned layer,
8 the digit line segment having a long axis defining a first direction;
9 an electrically insulating spacer layer disposed between the digit line
10 segment and the pinned layer;
11 a bit line including a segment in electrical contact with the free layer, the
12 bit line segment having a long axis defining a second direction
13 substantially perpendicular to the first direction;
14 a magnetic liner layer disposed around the bit line segment and
15 contacting the free layer.

1 27. (previously presented) The MRAM cell of claim 26 wherein the magnetic
2 liner layer is electrically conductive.

1 28. (previously presented) The MRAM cell of claim 26 wherein the bit and digit
2 lines are formed of a metal selected from the group consisting of Cu, W,
3 and Al.

1 29. (previously presented) The MRAM cell of claim 26 further including an
2 antiferromagnetic layer disposed adjacent to the pinned layer.

1 30. (previously presented) The MRAM cell of claim 26 wherein the magnetic
2 liner layer is formed of Permalloy.

1 31. (previously presented) The MRAM cell of claim 30 wherein the Permalloy is
2 between 16 and 22 atomic percent iron.

1 32. (previously presented) The MRAM cell of claim 30 wherein the Permalloy is
2 $\text{Ni}_{81}\text{Fe}_{19}$.

1 33. (previously presented) The MRAM cell of claim 26 wherein the magnetic
2 liner layer has a thickness of about 20Å to about 500Å.

1 34. (previously presented) The MRAM cell of claim 26 wherein the magnetic
2 liner layer has a thickness of about 30Å to about 100Å.

- 1 35. (previously presented) The MRAM cell of claim 26 wherein the pinned layer
2 is two ferromagnetic layers separated by a spacer layer.

- 1 36. (previously presented) The MRAM cell of claim 26 wherein the free layer is
2 two ferromagnetic layers.

37. (previously presented) An MRAM cell comprising:

- a magnetic tunneling junction including
 - a free layer,
 - a pinned layer, and
 - an insulating spacer layer disposed between the free layer and the pinned layer;
- a digit line including a segment disposed proximate to the pinned layer, the segment having a long axis defining a first direction;
- a bit line including
 - a segment in electrical contact with the free layer and having a long axis defining a second direction substantially perpendicular to the first direction,
 - a bottom surface abutting the free layer,
 - a top surface opposite the bottom surface, and
 - first and second vertical surfaces opposite one another and connecting the top and bottom surfaces; and
- a magnetic liner layer disposed around the bit line segment and contacting the first and second vertical surfaces and the top surface.

38. (previously presented) The MRAM cell of claim 37 wherein the magnetic liner layer also contacts the free layer.

1 39. (previously presented) The MRAM cell of claim 37 wherein the magnetic
2 liner layer is electrically conductive.

1 40. (previously presented) The MRAM cell of claim 37 wherein the bit and digit
2 lines are formed of a metal selected from the group consisting of Cu, W,
3 and Al.

Al
contd
1 41. (previously presented) The MRAM cell of claim 37 further including an
2 antiferromagnetic layer disposed adjacent to the pinned layer.

1 42. (previously presented) The MRAM cell of claim 37 wherein the magnetic
2 liner layer is formed of Permalloy.

1 43. (previously presented) The MRAM cell of claim 42 wherein the Permalloy is
2 between 16 and 22 atomic percent iron.

1 44. (previously presented) The MRAM cell of claim 42 wherein the Permalloy is
2 $\text{Ni}_{81}\text{Fe}_{19}$.

1 45. (previously presented) The MRAM cell of claim 37 wherein the magnetic
2 liner layer has a thickness of about 20Å to about 500Å.

1 46. (previously presented) The MRAM cell of claim 37 wherein the magnetic
2 liner layer has a thickness of about 30Å to about 100Å.

1 47. (previously presented) The MRAM cell of claim 37 wherein the pinned layer
2 is two ferromagnetic layers separated by a spacer layer.

1 48. (previously presented) The MRAM cell of claim 37 wherein the free layer is
2 two ferromagnetic layers.

Al
contd

1 49. (previously presented) An MRAM cell comprising:
2 a magnetic tunneling junction including
3 a free layer,
4 a pinned layer, and
5 an insulating spacer layer disposed between the free layer and the
6 pinned layer;
7 a digit line including a segment disposed proximate to the pinned layer,
8 the digit line segment having a long axis defining a first direction;
9 a bit line including a bit line segment in electrical contact with the free
10 layer and having a long axis defining a second direction
11 substantially perpendicular to the first direction; and
12 a magnetic sheath disposed around the bit line segment and formed from
13 the free layer and a magnetic liner layer.

1 50. (previously presented) The MRAM cell of claim 49 wherein the magnetic
2 liner layer is electrically conductive.

1 51. (previously presented) The MRAM cell of claim 49 wherein the bit and digit
2 lines are formed of a metal selected from the group consisting of Cu, W,
3 and Al.

1 52. (previously presented) The MRAM cell of claim 49 further including an
2 antiferromagnetic layer disposed adjacent to the pinned layer.

1 53. (previously presented) The MRAM cell of claim 49 wherein the magnetic
2 liner layer is formed of Permalloy.

1 54. (previously presented) The MRAM cell of claim 53 wherein the Permalloy is
2 between 16 and 22 atomic percent iron.

1 55. (previously presented) The MRAM cell of claim 53 wherein the Permalloy is
2 $\text{Ni}_{81}\text{Fe}_{19}$.

1 56. (previously presented) The MRAM cell of claim 49 wherein the magnetic
2 liner layer has a thickness of about 20Å to about 500Å.

1 57. (previously presented) The MRAM cell of claim 49 wherein the magnetic
2 liner layer has a thickness of about 30Å to about 100Å.

1 58. (previously presented) The MRAM cell of claim 49 wherein the pinned layer
2 is two ferromagnetic layers separated by a spacer layer.

- 1 59. (previously presented) The MRAM cell of claim 49 wherein the free layer is
2 two ferromagnetic layers.

60 - 88. (cancelled)
